

## DISPLAY ARRANGEMENT AND ELECTRONIC DEVICE

### TECHNICAL FIELD

**[0001]** The present invention relates to a display arrangement for electronic devices, and such an electronic device.

### BACKGROUND

**[0002]** Touch sensitive displays, popularly called touch screens, are widely used in user interfaces of electronic apparatuses. Traditionally, a transparent touch sensitive layer, e.g. working according to detection of resistive or capacitive changes as the layer is touched, is arranged on top of the display and the position being actuated by touch or tapping can be determined. The position can be determined by good accuracy, but the additional layer between the display and the user can be experienced as blurring the viewed image. Further, such a structure can be more sensitive to wear and damages. Touch sensitive displays which are more resistant to wear and damages may employ a strain gauge configuration where the screen is spring mounted on the four corners and strain gauges are used to determine deflection when the screen is touched. This makes mechanical mounting space consuming, and mostly too expensive for e.g. portable electronic devices or consumer products. Thus, there is a need for a structure of touch sensitive displays which overcomes or alleviates at least one or a few of the above demonstrated drawbacks.

### SUMMARY

**[0003]** The present invention is based on the understanding that

**[0004]** According to a first aspect, there is provided a display arrangement for electronic devices, comprising a display element comprising one or more layers arranged to provide electro-optical modulation of light or provision of patterned light for providing graphical content to a viewer, and a rigid protective layer; and a force sensitive layer arranged on, from a viewer, a distal side of the display element.

**[0005]** The rigid protective layer may be a glass layer or a layer of transparent and rigid polymer, such as polycarbonate or polymethyl methacrylate.

**[0006]** The force sensitive layer may be arranged only over a part of an area of the side of the display element.

**[0007]** The force sensitive layer may comprise at least one polyvinylidene fluoride film.

**[0008]** According to a second aspect, there is provided an electronic device comprising a display element comprising one or more layers arranged to provide electro-optical modulation of light or provision of patterned light for providing graphical content to a viewer, and a rigid protective layer; and a force sensitive layer arranged on, from a viewer, a distal side of the display element.

**[0009]** The rigid protective layer may be a glass layer.

**[0010]** The force sensitive layer may be arranged only over a part of an area of the side of the display element.

**[0011]** The force sensitive layer may comprise at least one polyvinylidene fluoride film.

**[0012]** The electronic device may be any of a mobile phone, a personal digital assistant, a digital camera, or a gaming console.

### BRIEF DESCRIPTION OF DRAWINGS

**[0013]** FIG. 1 schematically illustrates layer structure of a display element according to an embodiment of the invention.

**[0014]** FIG. 2 schematically illustrates layer structure of a display element according to an embodiment of the invention.

**[0015]** FIGS. 3a and 3b schematically illustrates an apparatus having a display arrangement according to an embodiment of the invention, where FIG. 3b is a section view along line A-A of FIG. 3a.

**[0016]** FIG. 4 schematically illustrates an alternative embodiment from a similar view as FIG. 3b.

**[0017]** FIGS. 5a and 5b illustrate a part of a display arrangement according to an embodiment of the invention, where FIG. 5b illustrates the display arrangement when a touch operation is present.

**[0018]** FIGS. 6 to 8 illustrate examples of apparatuses which can benefit of a display arrangement according to any of the embodiments demonstrated above, and examples of use.

**[0019]** FIGS. 9a and 9b illustrate a part of a display arrangement according to an embodiment of the invention, where FIG. 9b illustrates the display arrangement when a touch operation is present.

### DETAILED DESCRIPTION

**[0020]** FIG. 1 schematically illustrates layer structure of a display element 100 according to an embodiment of the invention. The display element 100 comprises a rigid protective layer 102, which preferably is arranged at a side which in use is directed towards a viewer, and thus towards an outer surface of an apparatus in which the display element 100 is to be used, as will be further elucidated below. The rigid protective layer 102 will protect display layers 104 from being damaged during use. Especially, when the display element is tapped or pushed upon touch operation, the rigid protective layer 102 will protect the display layers 104 from breaking. The rigid protective layer 102, as well as the display layers, will upon application of a force allow small local deformation without breaking. This small local deformation will, as will be elucidated below with reference to FIGS. 5a and 5b, and FIGS. 9a and 9b, enable detection of the applied force, which detection will be detected on the “backside” of the display element, i.e. at the display layer side of the display element. Thereby, no touch sensors need to be applied “on top” of the display element, i.e. between the image generating layers and the viewer, which will facilitate maintaining good image quality. Often, applying touch sensitive layer on top of displays gives an experience of a blurry image. On the other hand, by applying touch sensor on the backside of the display element will only provide relatively low resolution of the touch input compared to when applying touch sensors on top. However, for many applications, e.g. virtual keys on the display, or selection of user interface items, the achieved resolution will be enough.

**[0021]** FIG. 2 schematically illustrates layer structure of a display element according to an embodiment of the invention. The display element 200 comprises a rigid protective layer 202, which preferably is arranged at a side which in use is directed towards a viewer, and thus towards an outer surface